

CONTROL OF ALTERNARIA AND MELANOSE ON CITRUS USING CHLOROTHALONIL AND CUPRIC HYDROXIDE

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SUMMARY

Chlorothalonil and cupric hydroxide were evaluated at low (5 or 6) and high (10 or 11) spray frequencies for the control of alternaria (*Alternaria citri*) and melanose (*Diaporthe citri*) on tangelo and navel orange in the 1990/91 season. Cupric hydroxide gave the best control of alternaria on tangelo reducing the number of lesions on infected fruit by 75 and 57% for the high and low spray frequencies respectively, compared to untreated fruit. Chlorothalonil (high spraying frequency) and cupric hydroxide (low and high spray frequency) gave 58 to 67% control of melanose on tangelos. The high and low spraying frequency of chlorothalonil gave the best control of melanose on navel orange reducing the number of infected fruit by 70 and 46% respectively.

Keywords: citrus, alternaria, melanose, chlorothalonil, cupric hydroxide

INTRODUCTION

Melanose (*Diaporthe citri* Wolf) and alternaria (*Alternaria citri* Ellis & Pierce) are two of the main fungal diseases of citrus found in New Zealand, especially in the Bay of Plenty and Northland. Alternaria can cause high levels of reject fruit in the susceptible Seminole tangelo (Anon.1990). The pycnidia of melanose and the conidia of alternaria are produced on leaves and dead wood from which the spores spread on to the fruit and susceptible new shoot growth. Under wet conditions the spores germinate and penetrate the host.

Developing fruitlets are susceptible to alternaria and melanose for 3-5 months after fruit set. Disease symptoms appear as isolated infections with unsightly 1-3 mm diameter lesions on the skin but multiple infections can merge to form a larger mass of infected tissue. Management practices such as preventing prolific vegetative growth and pruning out dead wood may reduce the spread of both diseases but they are difficult to control without fungicide applications (Whiteside 1986).

This trial has evaluated the efficacy of chlorothalonil and a new formulation of cupric hydroxide, at two spraying frequencies, for the control of alternaria and melanose on Seminole tangelo and Carter's navel orange.

METHODS

The two trial areas were located on 12 year old commercial citrus blocks at Huanui Orchard, Glenbervie near Whangarei. The tangelo trees were 3 m high and planted at 3 x 5 m spacing and formed a hedge down the rows. The navel orange trees were 3.5 m high and planted at 4 x 5 m spacing. Both citrus cultivars received four cupric hydroxide (Kocide 101) sprays in the 1989/90 season, with the last spray being applied on 2 October 1990. A randomised block trial design with four replicates was used to evaluate treatments on both citrus cultivars. Plots consisted of 3-4 adjacent trees with no buffers between plots.

Treatments were cupric hydroxide (Champ) at 45 g/100 litres and chlorothalonil (Bravo 500F) at 150 g/100 litres at two spraying frequencies (Table 1) plus an unsprayed treatment. The cupric hydroxide used is a new formulation that has an average particle size of 0.35 µm. This is considerably smaller than other cupric hydroxide formulations available and nine times smaller than basic copper sulphate. This smaller particle size is said to give the product superior coverage compared to products with a larger particle

Proc. 45th N.Z. Plant Protection Conf. 1992: 95-98

size (Anon.1989).

Treatments were applied using a hand gun (1 mm Braglia nozzle) operating at 1200 kPa. Four litres of spray were applied per tree giving a rate of 2000 litres/ha for the navel orange and 2670 litres/ha for the tangelo. The application dates are given in Table 1.

TABLE 1: Times of fungicide applications to tangelo and navel orange

Date	Tangelo		Date	Navel orange	
	6 Sprays	11 Sprays		5 Sprays	10 Sprays
29.10.90	+	+	26.10.90	+	+
16.11.90	-	+	16.11.90	-	+
29.11.90	+	+	29.11.90	+	+
23.12.90	+	+	27.12.90	+	+
31.01.91	-	+	31.01.91	-	+
21.02.91	-	+	21.02.91	-	+
07.03.91	-	+	07.03.91	+	+
22.03.91	+	+	27.03.91	-	+
01.05.91	+	+	01.05.91	+	+
27.05.91	-	+	27.05.91	-	+
02.07.91	+	+			

Rainfall data were obtained from the Northland Regional Council Meteorological Station at the nearby Glenbervie Forest.

Treatments were assessed just prior to the commercial harvest. The navel orange trial was sampled on 15 July and the tangelo trial on 5 (replicate1) and 12 August 1991. Ten fruit were randomly picked from each of the two sides of one tree in the middle of each plot, giving 80 fruit per treatment. Small fruit (tangelo <50 g, orange <70 g) were not sampled. Each fruit was weighed and the alternaria and melanose infections on each fruit counted.

The data from the two sides of each tree were pooled before carrying out an analysis of variance. The numbers of melanose and alternaria lesions were analysed using logarithmic transformed data but geometric means are presented.

RESULTS

The navel orange flowered 3 weeks earlier than the tangelo. Rainfall over the 1990/91 season (883 mm) was 42% lower than the 30 year normal (1540 mm).

There was no significant difference between the weights of treated and untreated tangelos (mean 127 g SEM 1.2) and navel oranges (mean 141 g SEM 1.5) at harvest.

Results of the alternaria and melanose assessments are expressed as 'incidence' which is the percent of infected fruit and 'severity' which is the mean number of lesions on infected fruit (Tables 2 and 3).

Untreated tangelos had a 100% incidence of alternaria (Table 2). The cupric hydroxide and chlorothalonil treatments did not significantly reduce the incidence of tangelos infected with alternaria. Both cupric hydroxide treatments significantly ($P < 0.001$) reduced the severity of alternaria infections with 11 sprays significantly ($P < 0.05$) better than six.

Untreated tangelos had a 99% incidence of melanose. None of the treatments reduced the incidence of the disease. Both cupric hydroxide spray frequencies and the chlorothalonil 11-spray frequency significantly ($P < 0.01$) reduced the severity of melanose infections.

Untreated navel oranges had a low incidence of alternaria and none of the treatments reduced the incidence of the disease (Table 3). The chlorothalonil 10 spray frequency was the only treatment to significantly ($P < 0.05$) reduce the severity of alternaria infections.

TABLE 2: The effect of two spray frequencies of cupric hydroxide and chlorothalonil on alternaria and melanose on tangelo fruit.

Treatment	No. of sprays	Alternaria		Melanose	
		Incidence	Severity	Incidence	Severity
cupric hydroxide	6	99	12 ***	93	15 **
cupric hydroxide	11	90	7 ***	67	12 **
chlorothalonil	6	100	30	89	24
chlorothalonil	11	100	22	96	14 **
untreated		100	28	99	36
SED (approx)		3.5	4.3	11.2	4.4

Significance levels compared to untreated:

* = P<0.05

** = P<0.01

*** = P<0.001

TABLE 3: The effect of two spray frequencies of cupric hydroxide and chlorothalonil on alternaria and melanose on navel orange fruit.

Treatment	No. of sprays	Alternaria		Melanose	
		Incidence	Severity	Incidence	Severity
cupric hydroxide	5	19	2.2	80	13
cupric hydroxide	10	26	1.7	79	12
chlorothalonil	5	14	1.2	53 **	3
chlorothalonil	10	10	1.1 *	29 ***	2 *
untreated		18	1.8	99	37
SED (approx)		6.4	0.4	4.9	16.0

The incidence of melanose on untreated navel oranges was 99%. The two chlorothalonil spray frequencies significantly reduced (6 sprays P<0.01, 11 sprays P<0.001) the incidence of fruit infected with melanose. The chlorothalonil 10-spray frequency significantly reduced (P<0.05) severity of melanose infections on infected fruit.

DISCUSSION

Cupric hydroxide would be the preferred chemical for use on tangelo as it controlled both melanose and alternaria. Much of the benefit of the high compared to the low spray frequency of cupric hydroxide probably came from the enhanced protection of the fruit during the first 3-5 months of growth. It has been shown that as the citrus fruit matures it becomes less susceptible to infection by alternaria and melanose (Whiteside 1980; 1986).

Grade standards vary between packhouses, depending on the demands of the market. The Citrus Industry Planning Council has set a maximum allowance for the local market of 5 cm² for blemishes. The tangelos sprayed with cupric hydroxide would have met this standard. However, the fruit would not have met the nil tolerance required for export.

There was a much lower incidence of alternaria on the navel oranges compared with the tangelos. Chlorothalonil was the preferred chemical for use against both alternaria and melanose on navel orange with five applications giving levels of disease control well within the local standard set by the Citrus Industry Planning Council.

There are essentially two methods of preventing alternaria and melanose lesions on the fruit. One is to eradicate the source of spores on the leaves and dead wood. Previously captafol was used for this purpose (Whiteside 1977; 1980; 1986) but this chemical has been withdrawn. Copper and chlorothalonil sprays applied before fruit set are not considered effective for the control of alternaria and melanose (Whiteside 1977; 1980).

The second method, investigated in this study, involves applying a protectant fungicide to prevent the establishment of the disease on the fruit. The success of these protective sprays depends on identifying critical periods of spore release and fruit susceptibility to disease, as well as understanding how long each fungicide application will last under different climatic conditions (Whiteside 1977; 1980).

The incidence of alternaria infections on fruit was not significantly reduced on tangelos and oranges in these trials. The disease pressure in the orchard was undoubtedly responsible. In this study a high frequency of applications was not able to give total protection of the fruit over the sensitive period. Contributing factors may be the degradation of the chemical and dilution of the chemical due to fruit enlargement.

This study has shown that cupric hydroxide was more effective at protecting tangelos, and chlorothalonil more effective at protecting oranges, from alternaria and melanose disease. Further studies are required to more closely determine the frequency and timing of applications in order to maximise the effectiveness of each fungicide spray.

ACKNOWLEDGEMENTS

Yates New Zealand Ltd and ISK Biotech for financial assistance, Mr W.H. Hutchinson and Mr L. Hill of Huanui Orchards for their help, Mrs J. M. Kelly, Mrs N.B. Tapper and Mr G.S.C. Gill for assistance in running the trial and assessments.

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